



Department of Pesticide Regulation



Edmund G. Brown Jr.
Governor

MEMORANDUM

TO: Randy Segawa
Environmental Program Manager I
Environmental Monitoring Branch

Frank C. Spurlock, Ph.D.
Research Scientist III
Environmental Monitoring Branch

FROM: Bruce Johnson, Ph.D.
Research Scientist III
Environmental Monitoring Branch
916-324-4106

Original signed by

DATE: December 6, 2011

SUBJECT: COMPILATION OF STUDIES ESTIMATING NEAR SURFACE
CONCENTRATIONS OF 1,3-DICHLOROPROPENE OR CHLOROPICRIN

For the purpose of checking the realism of computer simulation studies and gauging assumptions about soil concentrations of fumigants, I have compiled a list of studies which have measured the soil air concentration of 1,3-dichloropene or chloropicrin at or near the surface beneath tarped applications (Table 1) shortly after fumigation. I found 19 measurements from 6 different studies. I converted the study units into ug and cm in order to provide units that were easy to compare with simulation results and consistent across studies. There were both drip and injection methods of application. The application depths ranged from 3 to 46 cm. The measurement depths were most commonly at ten cm, but a few more shallow. The time after application ranged about 2 h to 48 h. Finally, I normalized the concentration by dividing the reported measured concentration (ug/cm³) by the application rate (ug/cm²), which gives units of cm⁻¹.

The normalized concentrations for the higher barrier tarps (VIF and SIF) appear to be higher than those of the lower barrier tarps (HDPE and LDPE). I coded these two groups and tested the hypothesis that the medians were equal versus unequal using Kruskal-Wallis test. They were not statistically different (p~0.11). The sample size is small and associated factors such as length of time after application, measurement depth and application depth and application method all play a role.

The normalized concentrations ranged from 0.0003 to 0.026 cm⁻¹. The median normalized concentrations were 0.0018 cm⁻¹ and 0.0010 cm⁻¹ for high and lower barrier tarps, respectively.



References

- Ashworth, Daniel J., Fred F. Ernst and Scott R. Yates. 2008. Soil chamber method for determination of drip-applied fumigant behavior in bed-furrow agriculture: Application to chloropicrin. *Environ. Sci. Technol.* 42:4434-4439.
- Gao, Suduan, Thomas J. Trout, and Sally Schneider. 2008. Evaluation of fumigation and surface seal methods on fumigant emissions in an orchard replant field. *J. Environ. Qual.* 37:369-377.
- Gao, Suduan and Thomas J. Trout. 2007. Surface Seals Reduce 1,3-Dichloropropene and Chloropicrin Emissions in Field Tests *J. Environ. Qual.* 36:110B119
- Qin, Ruijun, Suduan Gao, Jason A. McDonald, Husein Ajwa, Shachar Shem-Tov, David A. Sullivan. 2008. Effect of plastic tarps over raised-beds and potassium thiosulfate in furrows on chloropicrin emissions from drip fumigated fields. *Chemosphere* 72:558-563.
- Thomas, J.E., Ou, L., Allen Jr, L.H., Vu, J.C., Dickson, D.W. 2006. Henry's law constants and mass transfer coefficients for methyl bromide and 1,3-dichloropropene applied to Florida sandy field soil. *Chemosphere* 62:980-988.
- Thomas, John E., L. Hartwell Allen Jr., Leslie A. McCormack, Joseph C. Vu, Donald W. Dickson and Li-Tse Ou. 2003. Diffusion and emission of 1,3-dichloropropene in Florida sandy soil in microplots affected by soil moisture, organic matter, and plastic film. *Pest Management Science.* 60(4):390-398.

Randy Segawa and Frank C. Spurlock Ph.D.

December 6, 2011

Page 3

Table 1. Measurements of 1,3-D or chloropicrin at or near the surface in tarped studies.

Source	Soil Type	Active Ingredient	App. Type	App. Depth (cm)	Rate Applied (ug/cm2)	Meas. Depth (cm)	Time After Application (h)	Conc. (ug/cm3)	Normalized Conc. (1/cm)	Tarp	Comments
Thomas et al. 2003	fine sand	1,3-d (CIS)	injection	30	975 (CIS only)	2	5	2	0.002	VIF	Containerized microplots
Ashworth et al. 2008	sandy loam	chloropicrin	drip	5	1500	5	(1st day)	39.2	0.026	SIF	SIF tarp, packed sampling chamber
Thomas et al. 2006	sand	1,3-d	injection	30	1982	0.5	43	0.6	0.0003	HDPE	Combined CIS and Trans
Gao et al. 2008	sandy loam	1,3-d	injection	46	4545	10	24	8	0.0018	VIF	Near shank line
Gao et al. 2008	sandy loam	1,3-d	injection	46	4545	10	24-48	7	0.0015	VIF	Between shank lines
Gao et al. 2008	sandy loam	1,3-d	injection	46	4545	10	24	8	0.002	HDPE	Near shank line
Gao et al. 2008	sandy loam	1,3-d	injection	46	4545	10	48	4	0.001	HDPE	Between shank lines
Gao et al. 2008	sandy loam	1,3-d	drip	20	3837	10	24	8	0.002	HDPE	Near drip line
Gao et al. 2008	sandy loam	1,3-d	drip	20	3837	10	48	4	0.001	HDPE	Between drip lines
Gao and Trout 2007	sandy loam	1,3-d	injection	46	3721	10	11	7	0.0019	VIF	Near shank line
Gao and Trout 2007	sandy loam	1,3-d	injection	46	3721	10	36-48	5	0.0013	VIF	Between shank lines
Gao and Trout 2007	sandy loam	chloropicrin	injection	46	2135	10	7-24	2.5	0.0012	VIF	Near shank line
Gao and Trout 2007	sandy loam	chloropicrin	injection	46	2135	10	11-24	2	0.0009	VIF	Between shank lines
Gao and Trout 2007	sandy loam	1,3-d	injection	46	3721	10	7-24	4	0.001	HDPE	Near shank line
Gao and Trout 2007	sandy loam	1,3-d	injection	46	3721	10	24	4	0.001	HDPE	Between shank lines
Gao and Trout 2007	sandy loam	chloropicrin	injection	46	2135	10	24	2.5	0.001	HDPE	Near shank line
Gao and Trout 2007	sandy loam	chloropicrin	injection	46	2135	10	24	2.5	0.001	HDPE	Between shank lines
Qin et al. 2008	sandy loam	chloropicrin	drip	3	3200	0	2	14.5	0.005	VIF	In tarp-soil air space